Effect of Experiential Learning Model based Instructional Material on Concept Formation, Problem Solving, and Mathematical Achievement of Middle-Stage Students

Synopsis

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in

EDUCATION

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1.1.0. INTRODUCTION

According to (Schoenfeld,2000) Mathematics education research has been equally fruitful. Mathematics education researchers study how people learn and are taught mathematics. This includes concept acquisition, group interactions, motivation, affect, reasoning, visualization, problem-solving, and the effect of various technologies. Research methods and background are borrowed from anthropology, sociology, and psychology, especially cognitive psychology, as well as from philosophy and artificial intelligence.

"Mathematics of child's thought processes" is the primary goal of mathematics education (NCF, 2005). The primary goal of mathematics learning is to help students to develop their internal thought processes. Mathematics helps students to develop a wide range of skills and abilities such as Problem-solving abilities, critical thinking, scientific attitude, creative thinking, and many other higher-order thinking skills.

A study by Banerjee (2012) in the Homi Bhabha Center for Science Research (Tata Institute of Fundamental Research), found that in India there is less emphasis on mathematical educational research. Mathematics educational research in India is present at various institutes, not in an autonomous form but as part of education departments at the universities and research centers set up by the government at state and district levels. The research that takes place at these institutions mainly focused on remedial material and teaching in the past, the trends are changing in contemporary times. He provides an overview of mathematics education research in India. The Indian education system is geared toward profit. A student who excels in mathematics prefers to pursue engineering over mathematical research. One of the reasons for not studying mathematics is a lack of knowledge about careers in mathematics. Engineering and teaching are the two most well-known professions in India in the field of mathematics.

Decades of educational research indicate that students use their unique learning styles (Bloom, 1956; Felder, 1996; Gardner and Hatch, 1989) in mathematics to accommodate the various learning styles, instruction should be multifaceted. This assertion is supported by a large body of literature, which includes textbooks, learning style inventories, and classroom implementation resources (Bodi, 1990; Dunn and Dunn, 1993; Felder, 1993; Liu and Reed, 1994).

According to research in applied psychology, problem-solving is best accomplished through a strategy-building approach. According to research on individual differences in skill acquisition, the fastest learners are those who develop concept-formation strategies (Eyring, Johnson, and Francis, 1993). Strategic choices and metacognition are also important in mathematics education research (Schoenfeld, 2000). As a result, an effective mathematical learning model should include strategy building as a learning style.

1.1.1. STUDY OF Programme of International Students Assessment (PISA) about Mathematics Framework 2022

The PISA 2022 mathematics framework defines the theoretical underpinnings of the mathematics assessment based on the fundamental concept of mathematical literacy, relating mathematical reasoning and three processes of problem-solving. The framework describes how mathematical content knowledge is organized into four content categories. It also describes four categories of contexts in which students will face mathematical challenges.

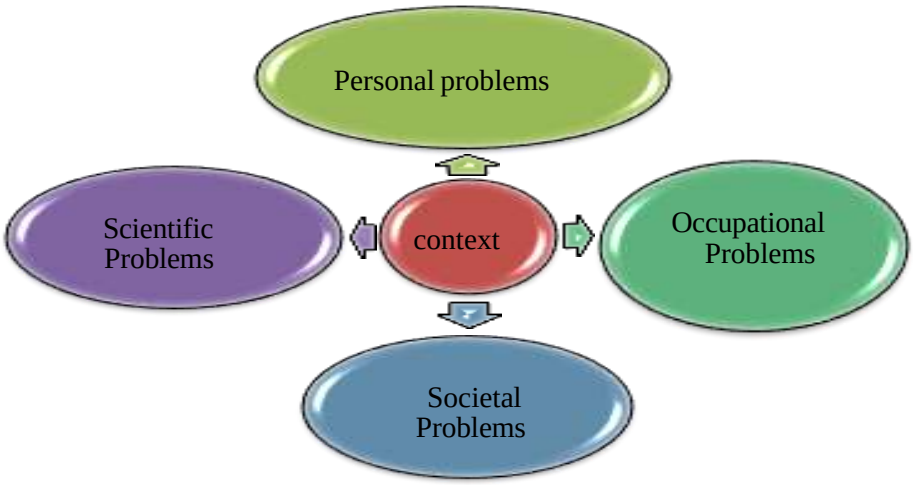

Fig. 1 Context of Problems (PISA study)

The PISA assessment measures how effectively countries are preparing students to use mathematics in every aspect of their personal, civic, and professional lives, as part of their constructive, engaged, and reflective 21st-century skills. An important aspect of the PISA study is to solve the problem in various contexts. Context is the aspect of the individual world in which are problem placed. The students choose the appropriate mathematical strategies to solve the problem. There are various contexts in individual worlds are shown in figure 1.

1.2.0THE THEORETICAL BACKGROUND OF THE VARIABLES

1.2.1. EXPERIENTIAL LEARNING

Experiential learning is an educational approach that emphasizes personal or practical experience in the acquisition of knowledge, skills, values, and attitudes. Students are encouraged to develop a passion for learning and a thirst for knowledge by engaging in authentic experiences that allow them to learn what they need to know. Four major characteristics need to be applied for a type of learning to qualify as Experiential. Those characteristics are defined based on Kolb Experiential learning and these all are shown by the given figure no. 2.

All the modules in Teaching and Learning for a Sustainable Future are based upon an experiential learning process that invite teachers to analyze and interpret information in a variety of forms (e.g., text, tables, diagrams, computer games, and linked WWW sites); review new knowledge in the light ofcurrent understandings; develop skills in a wide variety of teaching and learning strategies; and adapt newideas and skills to practical educational tasks, Teaching and Learning for a sustainable future, aMultimedia Education Program (UNESCO, 2010).

Experiential Learning Model

Kolb's Experiential Learning Model is a cyclical framework that highlights the importance of experience in the learning process. It includes four stages that learners navigate to convert their experiences into knowledge. Here is a detailed explanation of each stage:

Concrete experience

The learner encounters a new experience or engages in a reinterpretation process of an existing experience. The first step of Kolb's Experiential learning model would be what one knows first-hand, based on what they have done or seen. This is what Kolb calls the concrete experience stage.

Reflective observation

Concrete experiences are followed by reflective observation. As such, after engaging in an experience, learners should step back to reflect on the task or activity. This stage in the learningcycle allows the learner to ask questions and discuss the experience with others.

Abstract conceptualization

Reflective observation leads to conceptualization. In this stage, learners form new ideas or alter their

current understanding based on the reflections that arose from the previous stage. Learnersmove from reflective observation to abstract conceptualization when they begin to classify concepts and form conclusions on the events that occurred. As such, abstract conceptualization gives learners the chance to assess how their new ideas can be applied in the real world.

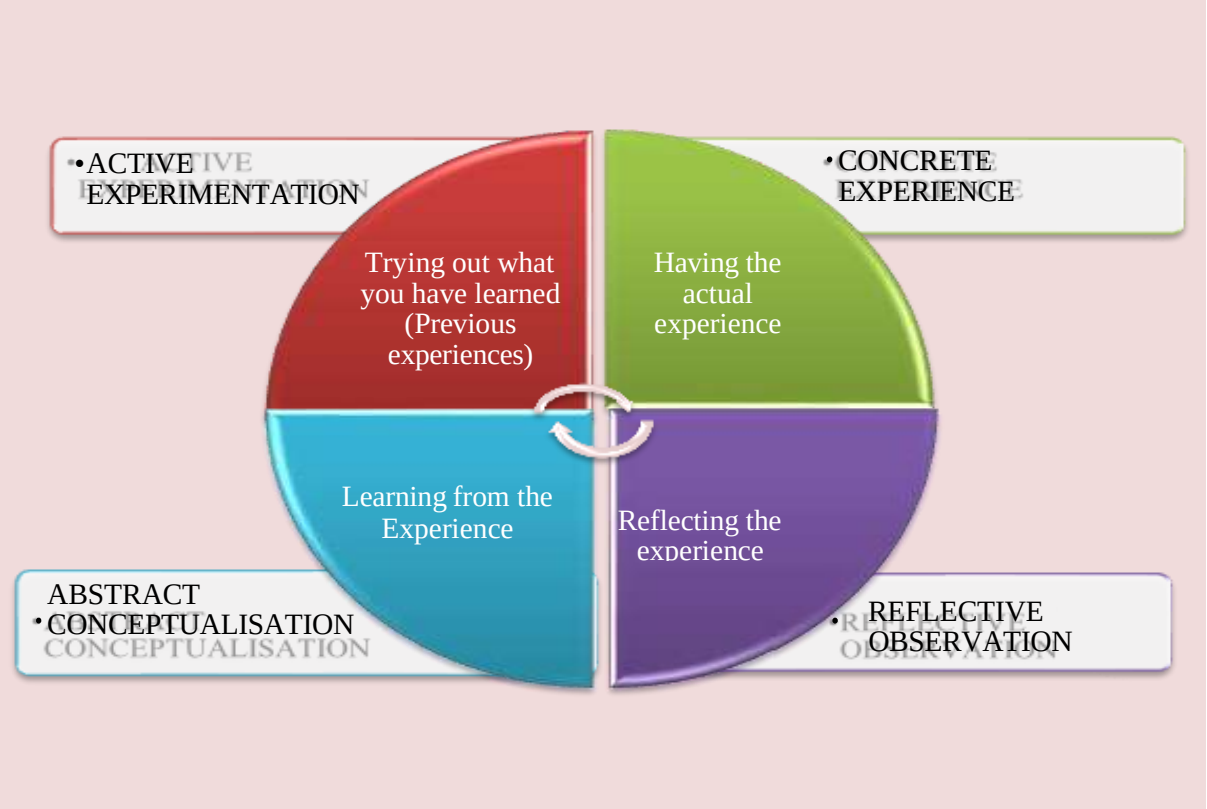

Fig.2 Kolb experiential learning model

Active experimentation

The last stage of the cycle involves active experimentation. At this stage, learners apply their newideas to the world around them. This allows them to see if there are any changes in the next occurrence of the experience. As such, this stage offers an opportunity for learners to test out their new ideas and lessons gathered from the experience. By actively experimenting with different concepts, individuals can learn how to associate what they have experienced with newideas and innovations.

Students' engagement in all the 4 stages of Kolb's experiential learning model is given in Fig. 3.

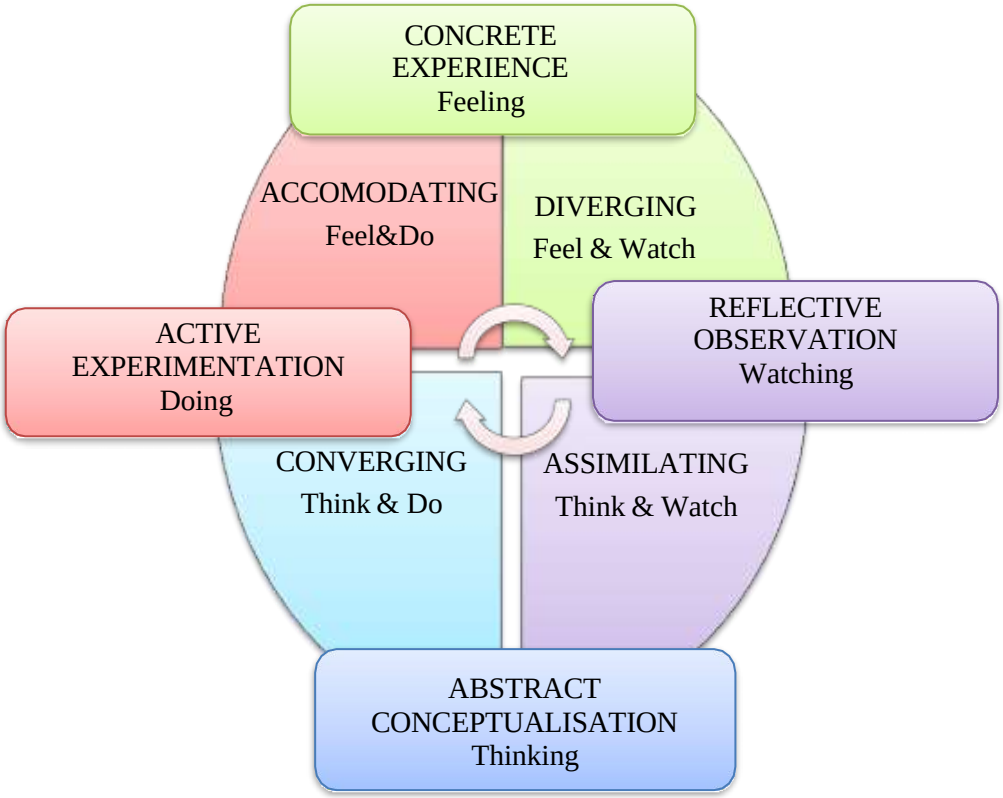

Fig. 3 Student engagement

Initiatives of CBSE to shift the paradigm from rote learning to Experiential learning

In NEP 2020, CBSE shifted the learning paradigm from rote learning to Experiential learning in upcoming academic years. As needed, schools plan curricular activities in such a way that students can connect the content of their learning areas and subjects to their own lives and the world in which they live. Experiential learning is a new method of learning. In recent years, CBSE has made several efforts toward implementing it. Experiential learning is a system in which students undertake projects and activities, go to the field, develop sensitivity, and learn to face challenges. Parents and teachers play an important role in providing students with an Experiential learning environment.

Different advances have been made by the Central Board of Secondary Education (CBSE) to make the teaching procedure student-friendly. Guidelines have been issued to execute educational programs in a student-driven way with the advancement of dynamic learning through a spotlight on reflections as well as making and building knowledge. Teachers have been encouraged to pursue comprehensive standards and not to label children as ‘slow learners’ ‘moderate students’ or ‘bright students’, or problem children. CBSE has presented Experiential Learning from the 2019-20 session onward. As needs be, the schools

plan curricular activities in such a way that it empowers the students to associate the content of their learning areas and subjects with their own lives and the world they live in. With the new method of learning, experiential learning, there will be certain changes in the study plan.

Experiential learning and multifaceted teacher

Experiential learning offers multiple roles to the teacher Indeed, it has been suggested that the ideal classroom would include each of the four processes in the Kolb model (Hartman, 1995; McCarthy, 1986). That is, full comprehension requires learning activities fitting each stage of learning (Jensen and Wood, 2000). Bernice McCarthy (McCarthy, 1986) has identified four roles for the teacher based on the Kolb model—evaluating, motivating, teaching, and coaching, respectively. Likewise, the four stages of Experiential learning described above simply have at least four different roles for the teacher of mathematics.

1. Allegorizing: The teacher is a storyteller
2. Integration: Guide and motivator.
3. Analysis: Source of information.
4. Synthesis: The teacher is a coach.

In the stages of allegorizing and analysis, the role of the instructor is one of active leadership, while in the stages of integration and synthesis, the instructor must allow and even motivate students to play a greater and more active role than the teacher.

1.2.2 CONCEPT FORMATION

Kendler (1961) defined concept formation as the acquisition or utilization of both of a common response to dissimilar stimuli.

So, concept formation is a process by which a person develops a common response to a general class of objects, which despite their differences in detail have certain features in common. (N.C.S. Rao, strategy in concept learning 1983)

According to Bruner (1956), concept learning is a form of classification. According to him, categorization activity has two elements, one is discovery learning and another is the spiral curriculum. Concept formation is the process of sorting given observations of phenomena into meaningful classes. The Individual creates classes called concepts taking into account observations of phenomena

meaningful to him.

The process of concept formation is complex and involves the interplay of the basic processes of perception, learning, remembering, and thinking and in many instances also the process of motivation. The process goes on throughout our life.

Bruner, Goodnow, Austin (1956) Conceptualizing is a form of categorizing. Categorizing is a means by which the objects around us are identified, a means of reducing the complexity of the environment. Categorizing and conceptualizing also reduce the need for constant learning. Once we realize that certain things fall into a certain class, we can understand their nature without relearning the definition of the class for every new member of the class we encounter (Bruner, Goodnow, Austin 1956)

Basic steps for concept formation

- Observation
- Generalization
- Differentiation
- Abstraction

1.2.3. MATHEMATICAL ACHIEVEMENT

National Education Commission (1964-66) suggested that "Science and Mathematics should be taught on a compulsory basis to all pupils as a part of general education during the first ten years of schooling." Mathematics has become the backbone for prosperity in all walks of life in the twenty-first century. Mathematics is known as the father of all sciences. It is impossible to consider any scientific study without first considering mathematics.

Since the beginning of formal education, academic achievement has been the deciding factor for the success of a student. It is assumed that the better the academic achievement, the more success one gets in life. Academic achievement refers to the level of learning of different students in different subjects.

A person has many problems in one's day-to-day life. Mathematics helps to analyze problemsand strategies to solve them. Mathematical achievement is the competency shown by the student in mathematics. It is the result of acquired skills and knowledge in mathematics. It can be described as knowledge achieved and the skills that the students have developed in the subject of mathematics.

1.2.4. PROBLEM-SOLVING ABILITY

According to Skinner (1956) Problem-solving ability is a process of overcoming difficulties that appear to interferewith the attainment despite inference.

According to Chris Dede (2009) problem-solving is a 21st-century skill, comprise skills, abilities,and learning dispositions that have been identified as being required for success in 21st-century societyand workplaces by educators, business leaders, academics, and governmental agencies.

Constructivism theory believes that pupils' knowledge is built up by actively reflecting on their experiences but not passively receiving from others (Radford, 2008). The human brain plays an important role in helping pupils to build a complex, powerful, and abstract mental structure. In mathematics education, one of the manifestations of constructivism is problem-solving (Evans, 2012),and emphasized as a reason for learning mathematics. Thinking mathematically acts as an attitude andan approach to the world of problem-solving.

NCF (2005) *"*Developing children's abilities for mathematization is the main goal of mathematics education. The narrow aim of school mathematics is to develop 'useful' capabilities, particularly those relating to numeracy – numbers, number operations, measurement, decimals, and percentages. The higher aim is to develop the child's resources to think and reason mathematically, to pursue assumptionsto their logical conclusion, and to handle abstraction. It includes a way of doing things, and the abilityand the attitude to formulate and solve problems." There are various models of problem-solving developed by different psychologist have been presented in the table no 1.

Table 1 Problem-solving model

POLYA (1945)	**ALAN SCHOENFELD (1985)**	**JOHN MASON(1985)**
1. Understanding the problem 2. Devising a Plan 3. Carrying out the plan 4. Looking back	1. Reading 2. Analysis 3. Exploration 4. Planning 5. Implementation 6. Verification	1. Getting Start 2. Getting Involved 3. Mulling Keeping 4. Going Insight 5. Being Skeptical 6. Contemplating

Polya (1945), Scholanfeld (1985), and Mason (1985) proposed their model for problem-solving and used various words and situations for problem-solving based on these models in the present study some words are proposed for problem-solving.

- Entry means understanding the problem.
- Analysis means finding the best alternative solution out of the all-possible situation.
- Attack using the best alternative solution for solving the given problem.
- Review the whole process of problem-solving.

1.3.0. EMERGENCE OF THE PROBLEM

To change the perception, curriculum developers and teachers must take into account what counts as Mathematics and how this knowledge itself may be related to the norms and values of diverse cultures **(Rosa, 2010).**

According to Manjula Bhargava, **the 2014 Field Medal winner and member of NEP 2020,** "The biggest mistake that happened in India after independence was the separation of teaching and research in India's higher education system. India has some fantastic research institutions like the Tata Institute of Fundamental Research, the International Centre for Theoretical Sciences, Indian Statistical Institutebut they are little islands of excellence. And then there is the whole teaching sector, state universitieswhere no research happens."

Roger Bacon (1214-1294), an English philosopher and scholar once said, "Neglect of mathematics works injury to all knowledge since he who is ignorant of it cannot know the other sciences or thingsof the world."

As early as 1968 The Kothari Commission had emphasized the importance of mathematics. It said, "To accelerate the growth of the national economy, science education and research should receive high priority. Science and mathematics should be an integral part of general education till the end of theschool stage*."*

Kolb's Experiential Learning model has 4 stages (Diverging, Assimilating, Converging, and accommodating), and 2 stages are based on Jean Piaget's theory of cognitive development (assimilationand accommodation). In these all-stages learner uses his/her thinking patterns and then act. In these stages, learners work actively and solve any problem. Both assimilation and accommodation are essential to how organisms build schemas about the world **(1952; see also Wadsworth, 2004).**

While assimilation deals with keeping existing knowledge and schemas intact and finding a new placeto

store information, accommodation involves changing one's existing knowledge of a topic **(Tan etal., 2017)**

Mathematics is directly related to the thought process of a learner, it develops higher-order thinking skills (HOTS). In mathematics classrooms, students learn many concepts but they forgethow these concepts are useful for them and how they use these concepts in daily life. Mathematics is interdisciplinary in nature, it correlates with many other subjects e.g. (science, statistics, economics, geography, etc.….).

Each learner needs knowledge, skills, and attitudes as their primary goals. Each student is unique and they all have different learning preferences. Additionally, they differ in intelligence, an affinity for certain interests, and home environments, all of which have an impact on how well he/she does in arithmetic. The achievement of a student's harmonious growth depends significantly on theirmath ability. The importance of mathematics has grown so much in today's rapidly changing world and with the advancement of science and technology, every parent now sets high standards for their children to meet. Achievement in mathematics is quite important in present days.

1.4.0. JUSTIFICATION OF THE STUDY

CBSE focuses upon to the paradigm shift from rote learning to experiential learning. Kolb's Experiential learning is one of the best models for mathematical learning it was developed by David Kolbin 1984. Good teaching begins with a genuine concern for students and an enthusiasm for the subject. Any benefits derived from this model are in addition to that concern and enthusiasm, so the researcher believes that nothing can ever or should ever replace the invaluable and mutually beneficial teacher-student relationship.

Learning mathematics is essential for all students in the middle stage because mathematics is the root of routine action, basic mathematics is necessary for all. Mathematics learning develops higher-order thinking skills among learners in the classroom, it develops problem-solving ability, thinking critically, and promotes the creativity of learners. The researcher chose this topic because research in mathematics is no less productive or efficient. The field of mathematics is full of opportunity but these days it's marginalized. In the context of India where Education Commission (1964-66) said that mathematical learning is related to the daily life of routine action. Commissions talk about to mathematization of learners' thinking or thought processes. In the middle stage, learners forget to relate their previous

knowledge with new knowledge, they forget to think critically, and they forget how to use previous knowledge to develop or generate new ideas. In the present scenario we can see that students feel fear about mathematics learning, they feel fear from mathematics.

Experiential Learning in Context of NEP2020

Experiential learning, including hands-on activities, arts and sports integration, and story-telling-based teaching methods, will be implemented at all stages as standard pedagogy in each subject, exploring the interconnections among different disciplines. To address gaps in learning outcomes, classroom interactions will move towards competency-based education. Assessment tools, encompassing assessment "as," "of," and "for" learning, will be aligned with the specified learning outcomes, skills, and dispositions for each subject and class. (p. 13 para 4.6)

The curriculum in each subject will be streamlined to its core essentials, allowing room for critical thinking and a more holistic approach to learning through inquiry, discovery, discussion, and analysis. The required content will emphasize key concepts, ideas, applications, and problem-solving. Teaching and learning will become more interactive, with questions encouraged and classroom sessions frequently featuring fun, creative, collaborative, and exploratory activities to foster deeper and more experiential learning. (p. 13 para 4.5)

The National Education Policy of 2020 in many ways aligns with the principles and significanceof experiential learning. This visionary policy for India recognizes the need for a holistic and transformative approach to education, and experiential learning plays a crucial role in achieving the objectives outlined in the NEP. (Lone, S. A. & Kour, S. J., 2024)

Kolb experiential learning model

NEP 2020 places a strong emphasis on experiential learning, which is the core of Kolb's model. This approach is designed to make education more engaging and effective by encouraging practical, hands-on activities in the curriculum. Additionally, it promotes internships, vocational training, and real-world problem solving (p. 3-4, 16, 20-21).

Alignment of Experiential Learning, Problem-Solving Ability, Mathematical Achievement, and concept formation

Experiential learning is a creative and activity-based endeavor in the field of education, wherein children

learn through hands-on experiences. This type of learning experience is capable of developing self-belief, positive attitude, decision-making, and problem-solving skills.

Shivani (2018), found that experiential learning programs significantly increase academic achievement and develop scientific attitudes among the students. After teaching through an experiential learning program, students achieved better scores than the conventional method.

Mathematical problem-solving about experiential learning is to compare with blooms taxonomy and Kolb cycle of experiential learning. Problem solving is a higher-order thinking skill that needs analysis, synthesis, and then creating the solution.

In experiential learning, concepts are equal to pre-developed thoughts and knowledge about something. When the students wanted to solve a problem, they used pre developed set of thoughts (Schemas) and make a new concept. In the whole process of experiential learning, all three variables solve the problem through experience or pre-developed concepts and this ability increases the academic achievement of the middle stage students.

1.5.0. RESEARCH QUESTIONS

1. Is there any effect of Experiential learning model-based instructional material on the Mathematical achievement of middle-stage students?

2. Is there any effect of Experiential learning model-based instructional material on theconcept Formation of middle-stage students?

3. Is there any effect of Experiential learning model-based instructional material on the Problem-Solving Ability of middle-stage students?

1.6.0. STATEMENT OF THE PROBLEM

The present study has been titled *"Effect of Experiential Learning Model-based Instructional Material on Concept Formation, Problem Solving, and Mathematical Achievement of Middle StageStudents."*

1.7.0. DEFINITION OF THE KEY TERMS

1.7.1. EXPERIENTIAL LEARNING

"The process whereby knowledge is created through the transformation of experience." according to him, the way to gain knowledge is by understanding an experience and suitably applying the learning from that experience in other situations." David Kolb (1984)

Operational definition

In the present study, Experiential learning means 'learning by doing or learning through previous experiences. It includes hands-on experiences. Learning by using various strategies or abstract situations. It involves actively engaging in activities, reflecting on those experiences, and applying the insights gained to new situations.

1.7.2 EXPERIENTIAL LEARNING MODEL

Kolb's Model for Experiential Learning – a model for helping learners to learn effectively. Experiential Learning model is a holistic perspective on learning that encompasses experience, perception, cognition, and behavior.

Operational definition

In the present study, the Experiential learning model is the model presented by David A. Kolb. In this model 4 stages are given; those stages are focused upon the active participation of the students in the whole process. These stages are based on learning by doing or learning through previously developed concepts.

1.7.2. CONCEPT FORMATION

According to Bruner (1956) - "A theory of Instruction, in short, is concerned with how, whatone wishes to teach, can best be learned, with improving rather than describing learning".

Operational definition

In the present study, the concept is the pre-learned experiences that help a learner to the formation of concepts of a subject and construct new knowledge. A student who studies mathematics in the previous class and how to apply these concepts which are a study in class VII in class VIII.

1.7.4 MATHEMATICAL ACHIEVEMENT

Achievement in mathematics i.e., mathematical achievement of a student is affected by many psychological factors like interest, attitude, aptitude, intelligence, creativity, motivation, anxiety, adjustment, etc. A student's learning and achievement in the subject ofmathematics depends upon their attitude and interest toward it. **(**Patel, 1984 &Heinze et al.2005).

Operational definition

Mathematical achievement refers to the student's proficiency in mathematics. It is the result of knowledge

or information gained, comprehension, skills, and techniques developed in the subject of mathematics at a specific stage. Its metric is the score on the mathematics achievement test.

1.7.5. PROBLEM-SOLVING ABILITY

According to Gagne (1965) -"Problem-solving is a set of events in which human beings were rules to achieve some Goals"

Operational definition

In the present study, Problem-solving is the top phase of learning problem-solving includes many higher-order thinking skills, and problem-solving ability means the ability to construct knowledge withthe use of previous experiences and schemas.

1.7.6. MIDDLE STAGE

According to NEP (2020)-The middle stage comprises three years of education. It builds on the pedagogical and curricular style of the preparatory stage. The introduction and discussion of abstract concepts are done in this stage. It helps in preparing students across various streams. Experiential learning is explored with different subjects.

Operational definition

The middle stage will be from classes 6^{th} to 8^{th} (age group 11 to 14). It will comprise experimental learning in mathematics, sciences, social sciences, arts, and humanities. This level of school Instruction will focus on critical learning objectives, which is a significant departure from the rote learning methods that have long been used in our educational system**.**

1.8.0. VARIABLES OF THE STUDY

In the present study, the variables are categorized as:

1. Independent variable
2. Dependent Variables
3. Extraneous Variables (Controlled)

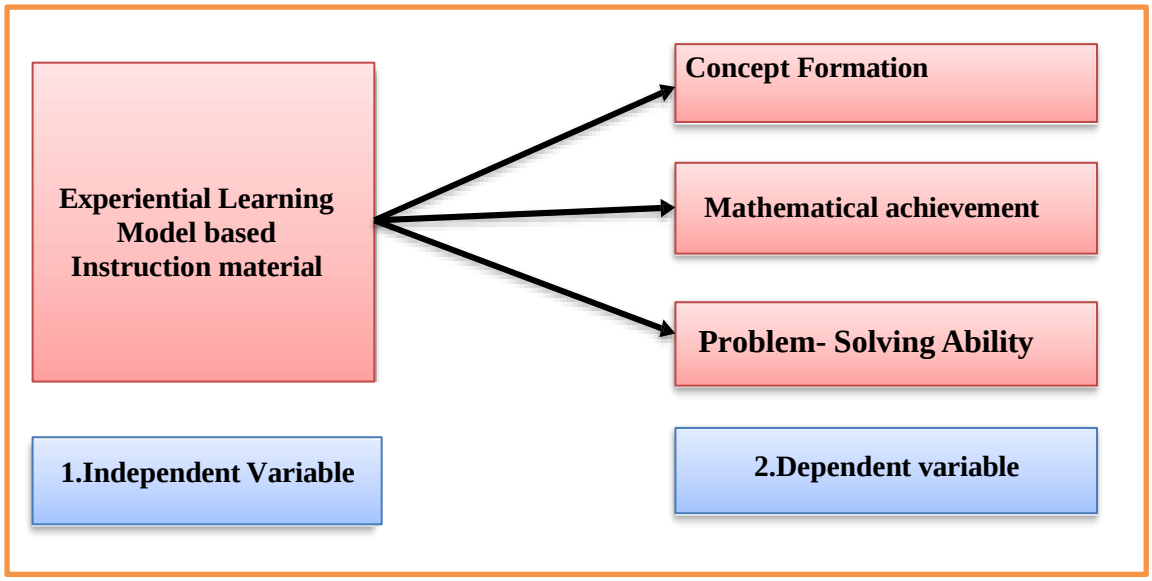

Fig. 4 Variables of the study

3.Extraneous Variable

The extraneous Variables are controlled by the identification of effective variables and using the effective strategy of control. The subject-related variables, situation-related variables, and sequence-related variables have been controlled through various types of controlling techniques.

1. Subject-related variables (age, sex, grade, etc.)
2. Environment-related variables (light, temperature, noise, etc.)
3. Sequence-related variables (fatigue, practice etc.

Table 2 Control of Extraneous Variable

Types of Extraneous Variables	**Control Variable**	**Methods of Controlling**
Subject-Related Variables	Age Grade Motivation Anxiety	Matching is equally distributed across the groups. Homogeneous Group (Similarities inparticipants)
Environment-Related Variables	Light, Temperature, Noice, Classroom	Providing similar conditions Controlled setting
Sequence-Related Variable	Fatigue, Practice Co-operation Schedule	By counterbalancing Arranged the order of tasks

To eliminate the effect of controlled variables the researcher statically uses the Ancova Technique.

1.9.0. OBJECTIVES OF THE STUDY

1. To develop experiential learning model-based instructional material on mathematics for middle-stage students.

2. To assess the effect of experiential learning model-based instructional material of mathematics on the Conceptformation of middle-stage students.

3. To assess the effect of experiential learning model-based instructional material of mathematics on theMathematical achievement of middle-stage students.

4. To find the effect of experiential learning model-based instructional material of mathematics on the Problem-solving ability of middle-stage students.

1.10.0. HYPOTHESES OF THE STUDY

Ha1- There will be a significant effect of experiential learning model-based instruction material onthe Concept formation of middle-stage students.

Ha2- There will be a significant effect of the experiential learning model-based instruction material model on the Mathematical achievement of middle-stage students.

Ha3- There will be a significant effect of the experiential learning model-based instruction material model on the Problem-solving ability of middle-stage students.

1.11.0. DELIMITATIONS OF THE STUDY

1. In the present study Instructional material will be developed on Kolb's Experiential model only.
2. The present study will be delimited to the VIII class.
3. The present study will be delimited to Agra City only.
4. The present study will be delimited to the CBSE board.

1.12.0. RESEARCH METHOD

To fulfill the purpose of the study researcher will use quasi-experimental research method. Thismethod will be used in an intact condition of the classroom.

1.13.0. SAMPLE OF THE STUDY

To fulfil the purpose of the research the researcher purposively selected 100 students of class VIII. The researcher will form 2 groups of 50 students in each group or section-wise intact group (experimental

group and control group)

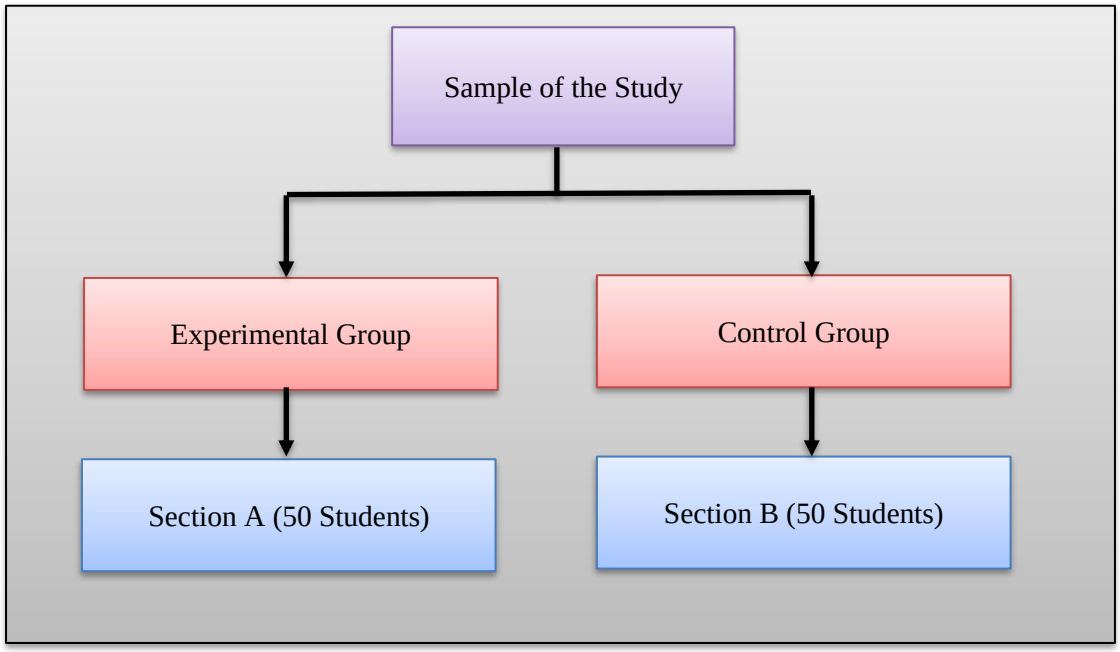

Fig. 5 Sample of the Study

1.13.0. SELECTION OF SAMPLING UNIT

Table 3 Selection of Sampling Unit

Level of the students	**Middle Stage**
Age	(11-14) year
Class	VIII (Purposive sampling)
Subject	Mathematics
No. of students	100 or two sections of class VIII
Selection of groups Experimental and control (Intact Group)	Section A (experimental)Section B (control)

1.14.0. RESEARCH DESIGN

Non-randomized Two group pre-test and post-test designs will be used in the present study

Table 4 Research Design

Groups	**Pre- Test**	**Intervention**	**Post- Test**
The Experimental Group (50 Students)	Concept formation, Mathematical achievement, and Problem- solving Abilities	The teaching of mathematics through Experiential learning model- based Instruction material (4 Week Program)	Concept formation, Mathematical achievement, and Problem-solving ability
Control Group (50 students)	Concept formation, Mathematical achievement, and Problem-solving ability	The teaching of mathematics through running method (4-week program)	Concept formation, mathematical achievement, and Problem- solving abilities

1.15.0. TOOLS TO BE USED FOR DATA COLLECTION

Table 5 Tool to be used for data collection

Sr. No.	Variables	Name of tools &technique
1	IV (Independent variable)	Experiential Learning Model-based Instruction material of mathematics.
2	DV1 Concept formation	Self-constructed tool
3	DV2 (Mathematical achievement)	Self-constructed tool
4	DV3 (Problem-solving ability)	Self-constructed tool

1.16.0. PROCEDURE OF THE STUDY

In the present study, the researcher will use a quasi-experimental research method by taking twogroups of pre-test and post-test design

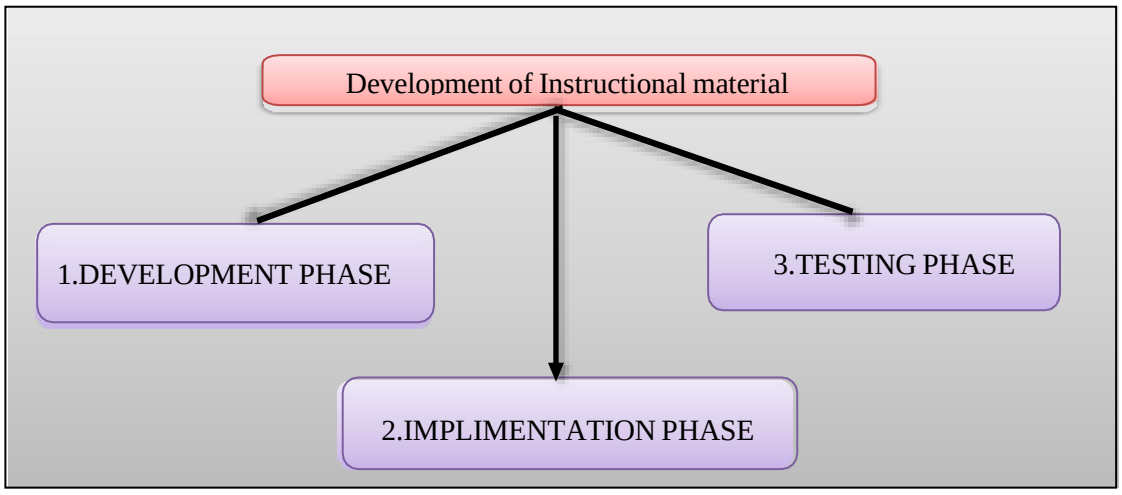

Fig. 6 Procedure of the study

1. Development Phase

In the Phase of material development researcher first analyze the syllabus of the class VIII textbook and then selects the best experiential learning strategy that is suitable according to the given syllabus. After doing that researcher develops the instruction material, tests it, and after getting an expert opinion finalizes the material.

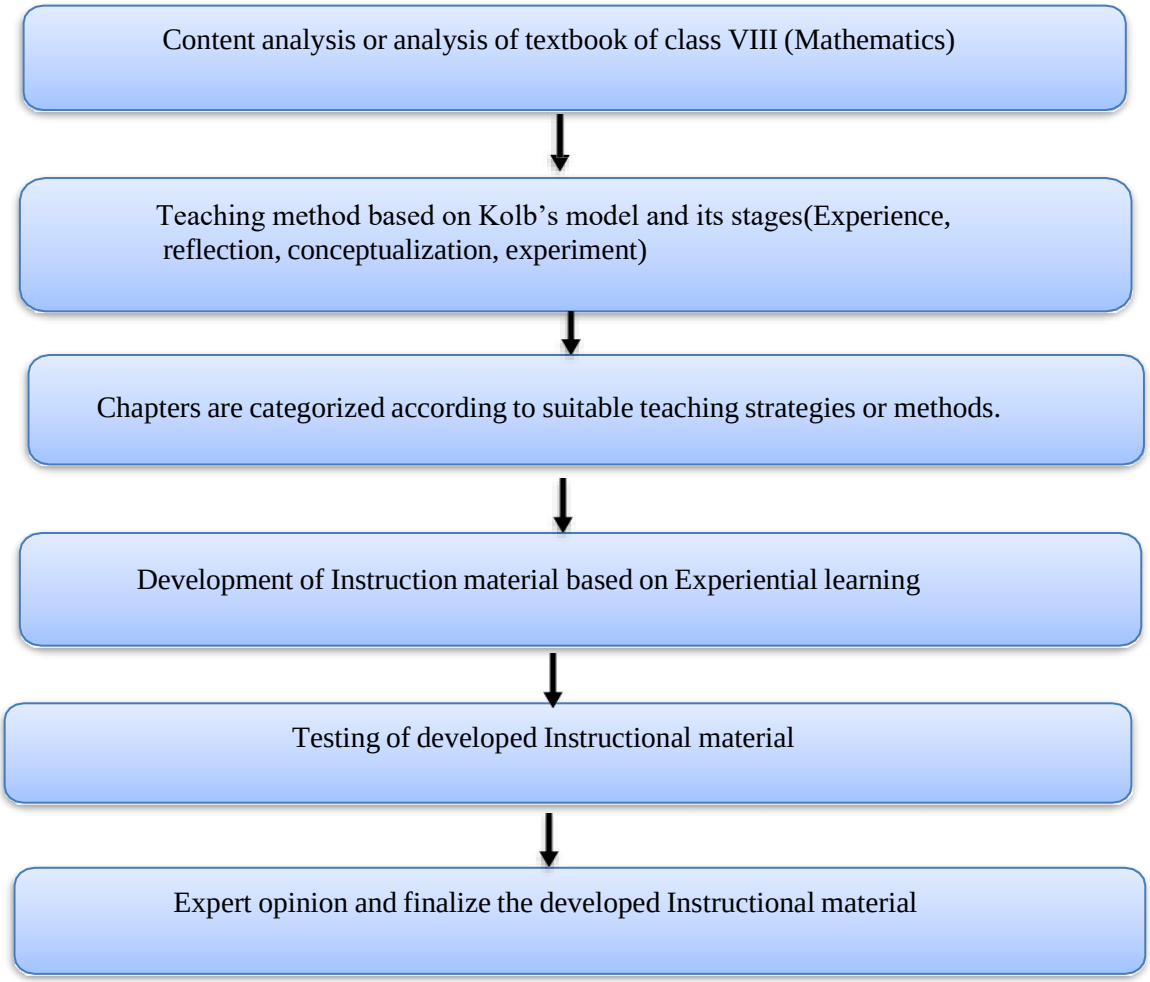
Content analysis or analysis of textbook of class VIII (Mathematics)
Teaching method based on Kolb's model and its stages(Experience, reflection, conceptualization, experiment)
Chapters are categorized according to suitable teaching strategies or methods.
Development of Instruction material based on Experiential learning
Testing of developed Instructional material
Expert opinion and finalize the developed Instructional material

Fig. 7 Developmental Phase

2. Implementation Phase

In this phase researcher prepares 20 lesson plans based on developed instructional material and the researcher will provide teaching for 30 days (working) for the experimental group through developed lesson plans.

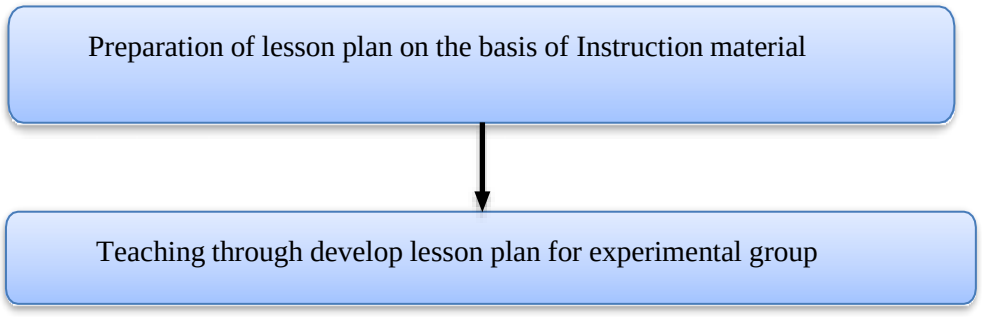
Preparation of lesson plan on the basis of Instruction material
Teaching through develop lesson plan for experimental group

Fig. 8 Implementation Phase

3. **Testing Phase**

In this phase of the study researcher collected the data from the groups, analysis & interpreted thedata. At last researcher prepares the research report based on analysis.

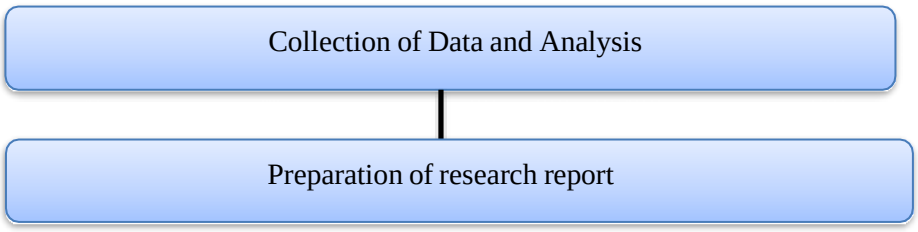

Fig. 9 Testing Phase

1.17.0. STATISTICAL TECHNIQUES

1. Descriptive statistical technique: Mean and standard deviation
2. Inferential statistical technique: t-test and ANCOVA (analysis of co-variance)

1.18.0. SIGNIFICANCE OF THE STUDY

Experiential learning model-based Instruction material will help teachers to develop more appropriate learning opportunities learners generally learners forget how previous learning experiences help to gain new knowledge or problem-solving. Kolb's model helps teachers design activities that will give opportunities for learners to learn in ways that suit the learners' learning styles; and focuses on activities that enable learners to go through each of the four stages of the Experiential learning cycle.Many insights and potential improvements to mathematical Instruction have come from educational research, applied psychology, and mathematics education research. However, as has been realized in other fields, classroom teachers must translate the findings of that research into a usable format. This article's four stages of mathematical learning speak to this purpose. The significance of 18 different learning styles shas been demonstrated by educational researchers. Applied psychologists have demonstrated the significance of skill development stages. Mathematical researchers have identified numerous areas in which mathematical Instruction can and should be improved.

The researcher simply combined these ideas into a working model that describes what students might encounter in math classes. According to the model, concepts should be allegorized first, integrated second, analyzed third, and synthesized last. It implies that teachers should take on a variety of roles in

the classroom to meet the needs of students at various stages of learning, such as storytellers during the allegory stage and coaches during the synthesis stage.

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